

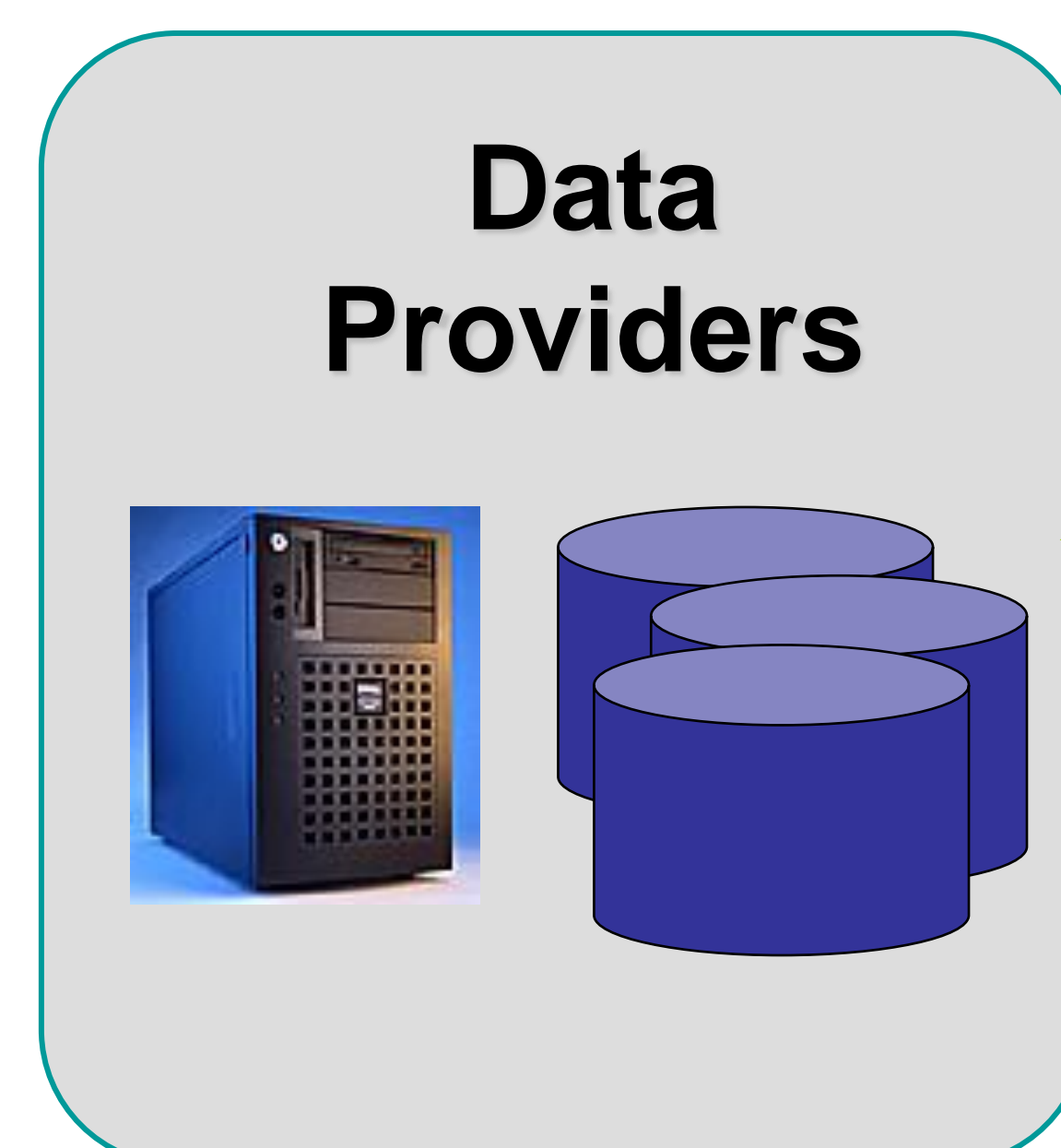
Building the Next Generation of Science Data Systems Using Service-Oriented Software Reuse

NASA relies on the science community to identify and prioritize leading-edge scientific questions and the observations required to answer them. At the request of NASA, NOAA, and USGS, the National Research Council completed its first decadal survey for Earth science, Earth Science and Applications from Space. For the next decade, the survey identified fifteen new space missions for NASA and three missions for NOAA. As the number of missions increases, so do the complexity and costs of the data systems that must transform, analyze, process, and manage data and implement products. There will be demands for massive improvement in productivity for the next huge wave of scientific innovations that would have the potential to solve problems that we cannot envision tackling today. Real-time analytics and massive data management will emerge as some of the most challenging tasks.

Existing science data systems are heterogeneous across operating systems, applications, system software, and infrastructure, and it is expensive in cost and time to develop new systems and applications. Service-Oriented Architecture (SOA) is a collection of services that can communicate with each other. With its loosely coupled nature, SOA allows the science community to plug in new services or upgrade existing services in a modular fashion to address the new products and/or data streams being served. Many existing applications can be used with a SOA. Service-oriented software reuse provides the option to make these services reusable and consumable across the entire community, and safeguards existing infrastructure investments by exposing the existing enterprise and legacy applications as services.

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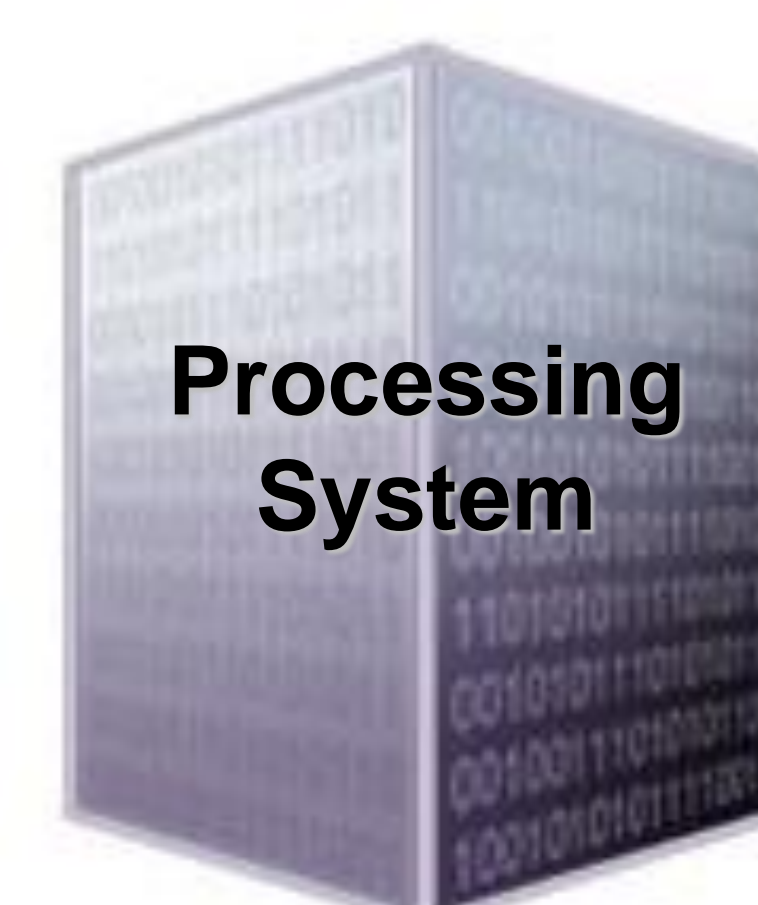


Data Provider Services

Ground Systems

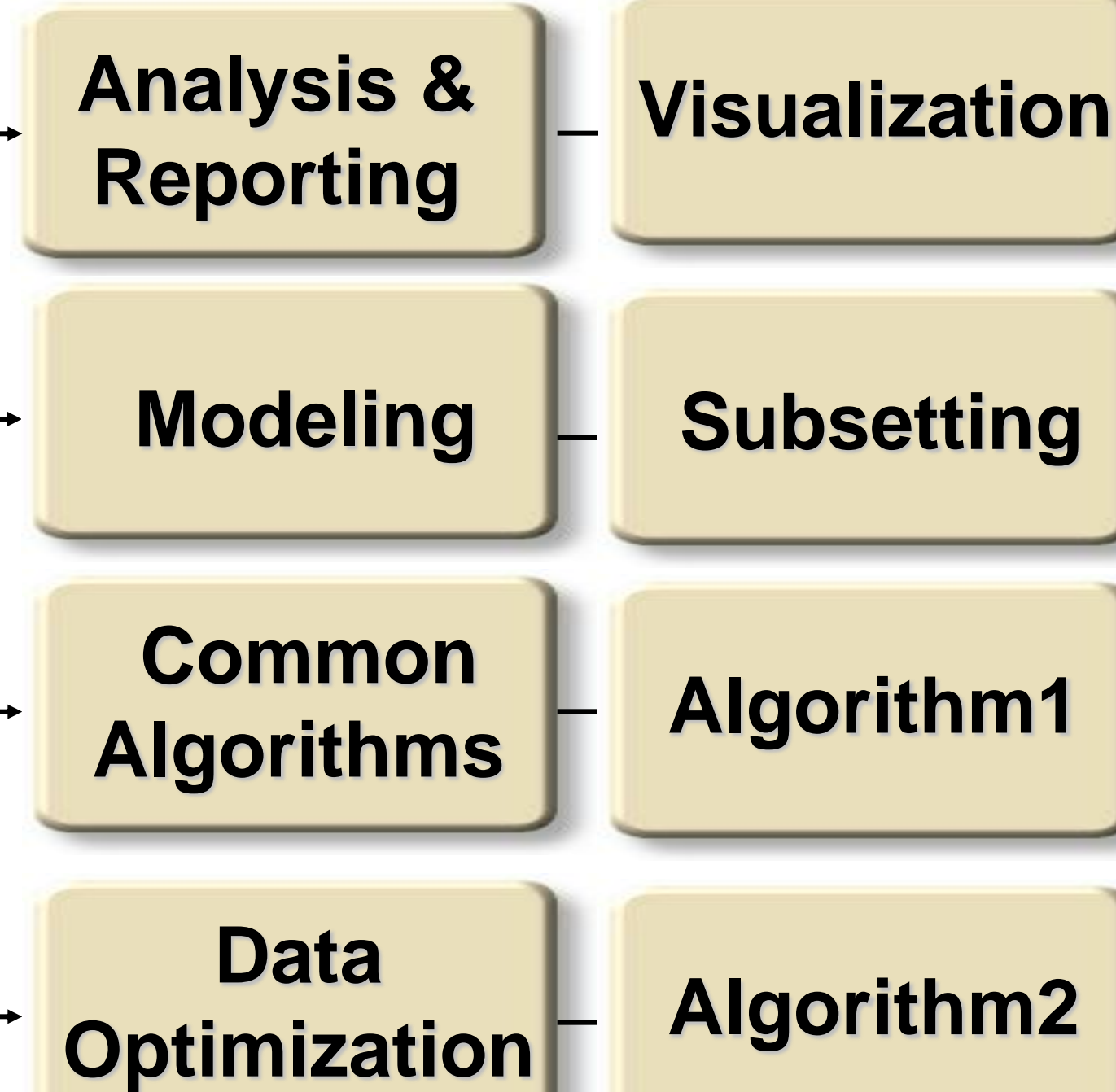
Data Download Services

Processing Framework



Workflow Layer

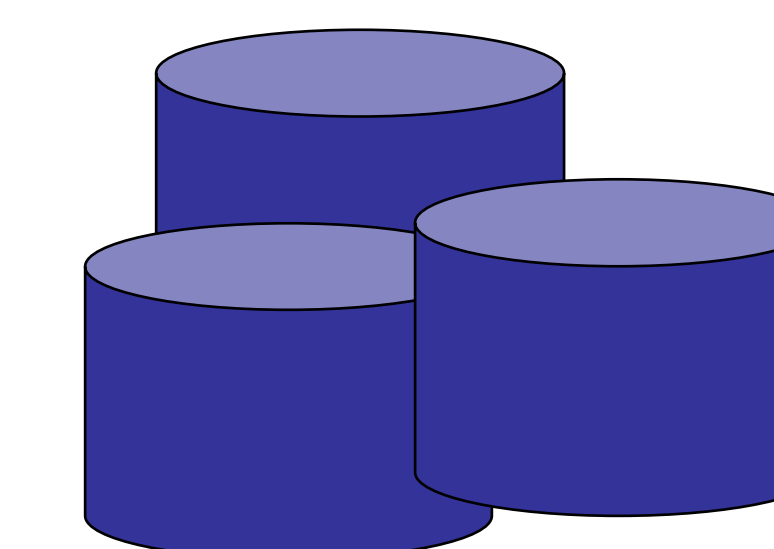
User Services



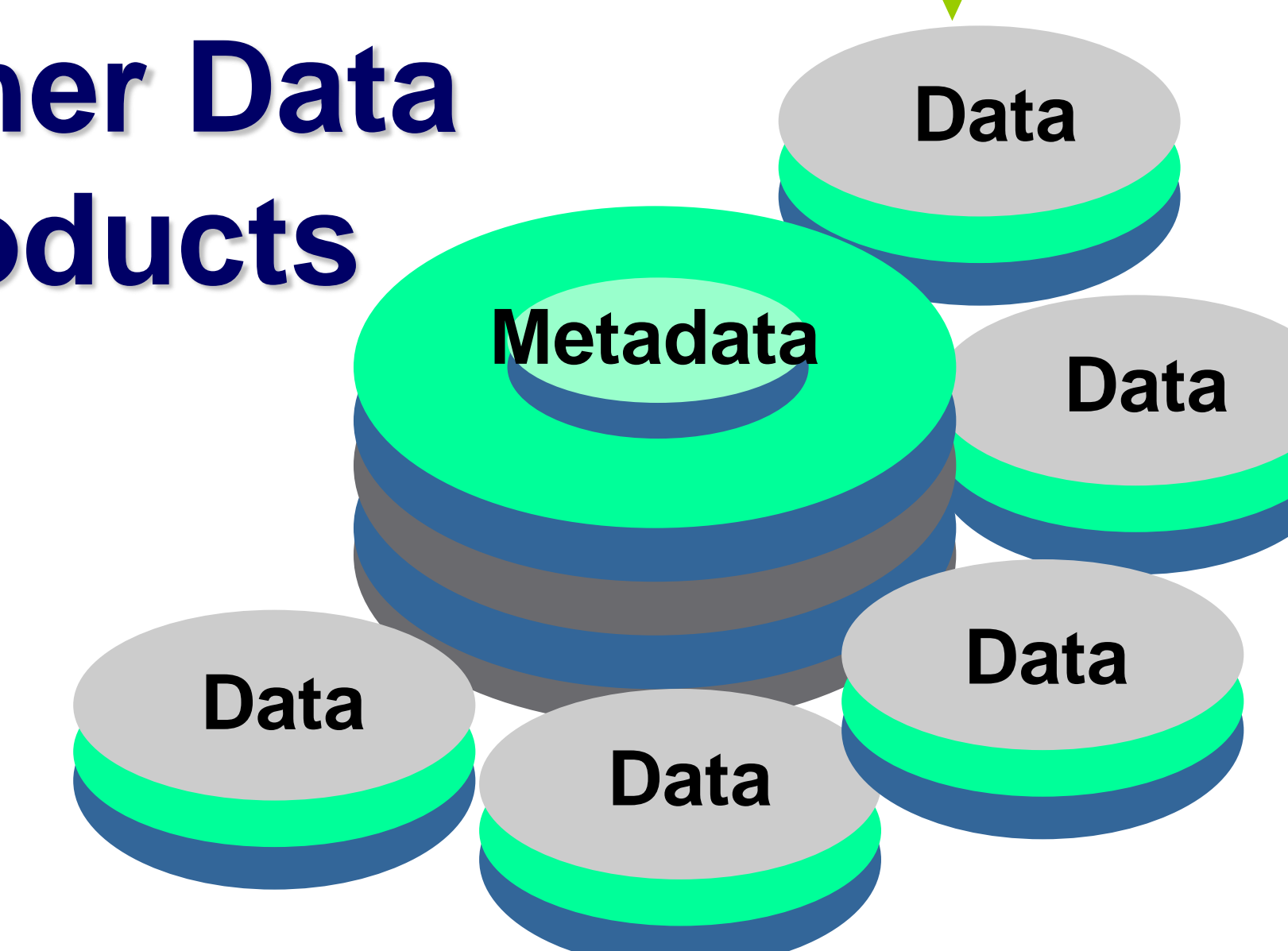
Users



Online Data Products



Other Data Products

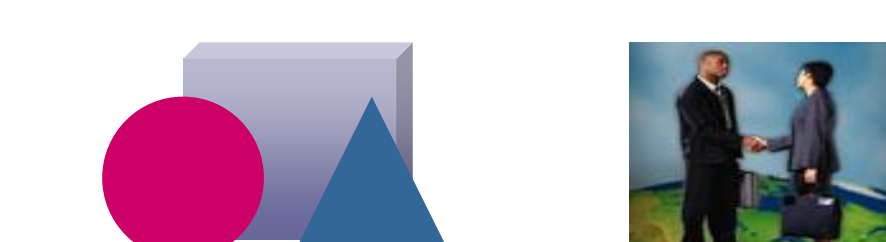


Partner Services

Processing Services

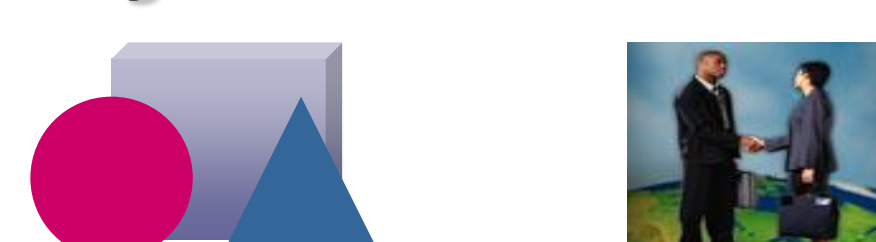
Outreach Services

Service Partners



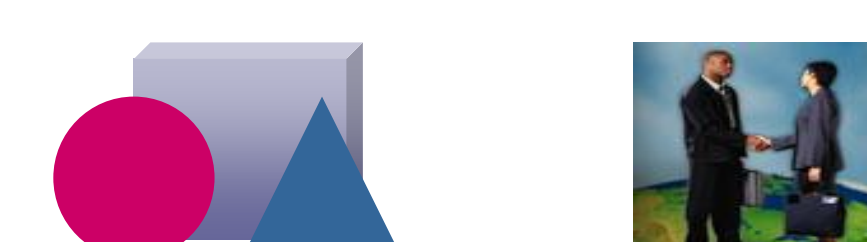
External Services

Cycle Partners



External Processing

Outreach Partners



External Data Storage

Resources Relevant to Software Reuse in Earth Science Data Systems

- Earth Science Data Systems Software Reuse Working Group (2009). Earth Science Software Reuse, <http://www.esdswg.com/softwarereuse/>
- HDF-EOF Tools and Information Center (2009). The HDF Group, <http://hdfeos.org/software.php>
- Innovative Partnerships Program (IPP) Office (2009). Featured Technologies, <http://ipp.gsfc.nasa.gov/technologies.html>
- National Aeronautics and Space Administration (2007). Systems Engineering Handbook, SP-2007-6105 Rev1, Washington, D.C.

References Relevant to Software Reuse in Earth Science Data Systems

- Finnigan JV, Blanchette J (2008) A Forward-Looking Software Reuse Strategy. Proceedings of the 2008 IEEE Aerospace Conference, pp. 1–9, ISBN 978-1-4244-1487-1, Big Sky, Montana, March 2008, IEEE Press, New York
- Mankins JC (1995) Technology Readiness Levels: A White Paper. Available via NASA. <http://www.hq.nasa.gov/office/codeq/trl/trl.pdf>. Accessed 20 July 2009
- Marshall JJ, Olding SW, Wolfe RE, Delnore VE (2006) Software Reuse Within the Earth Science Community. Geoscience and Remote Sensing Symposium, 2006. IGARSS 2006. IEEE International Conference on, pp.2880–2883, July 31, 2006 – Aug. 4, 2006. doi: 10.1109/IGARSS.2006.740
- Murray A, Schoppers M, Scandore S (2009). A Reusable Architectural Pattern for Auto-Generated Payload Management Flight Software, Proceedings of the 2009 IEEE Aerospace Conference, pp. 1–11, ISBN 978-1-4244-2621-8, Big Sky, Montana, March 2009, IEEE Press, New York
- Orrego AS, Mundy GE (2007) A Study of Software Reuse in NASA Legacy Systems. Innovations in Systems and Software Engineering 3(3), 167–180. doi: 10.1007/s11334-007-0027-y
- Ramamurthy MK (2006) A New Generation of Cyberinfrastructure and Data Services for Earth System Science Education and Research. Adv. Geosci. 8:69-78. Available via ADGEO. <http://www.adv-geosci.net/8/69/2006/>. Accessed 23 Jun 2009
- Samadi S, Gerard R, Hunter M, Marshall JJ, Schweiss RJ, Wolfe RE, Masuoka EJ (2007). Reusing Software to Build Data Processing Systems, Proceedings of 2007 IEEE Aerospace Conference, pp. 1–12, ISBN 1-4244-0525-4, Big Sky, Montana, March 2007, IEEE Press, New York